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To report research on different instructional methods and variables, to indicate limitations of the research, and to suggest criteria for methods for particular learning goals, this review discusses and evaluates several major instructional methods: lectures, lesson-demonstration, programed instruction, case studies, tutorials, brainstorming, discussion groups, sensitivity training, role playing, system training, discovery training, student centered learning, and instructor centered learning. Cognitive objectives (emphasizing remembering something learned or solving intellectual problems and reordering information) and affective objectives (emphasing a feeling, tone, emotion, or degree of acceptance or rejection) relate to each other and to the instructional methods above. Several variables affect teaching methods: style of leadership and supervision, the classroom communications network, size of the group, the clash between teaching principle or knowledge, teaching aids, and classroom climate. More research on teaching procedures is needed, yet enough guidelines exist to help teachers desiring to improve their students' learning. (jf)

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TECHNICAL TRAINING COMMAND

RESEARCH SECTION.

TRAINING METHODS

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TRAINING METHODS

AN ANALYSIS OF THE RESEARCH FINDINGS

Research Section
Headquarters Technical Training Command

1st June 1966

TABLE OF CONTENTS

		Page
Preface		1
Section 1 :	Background to the Research Findings	2
Section 2 :	The Effectiveness of Different Training Methods	11
Section 3 :	Variables Affecting Training Methods	38
Section 4 :	Conclusion	52
Section 5 :	Bibliography and References	55

PREFACE

1. Educational problems have not attracted the interest of serious research workers until very recent times. Although a number of descriptive studies were undertaken in the nineteenth century, educators have been slow in recognising the impact that research can have on educational progress. Today, more and more effort is being devoted to the field of educational research, and a number of new and important journals have come into existence. Although educational philosophy and practice are beginning to be profoundly affected by the findings of the many research workers investigating the field, there is still little agreement on the procedures to be adopted, the experimental designs required and the areas requiring priority of attention.

2. One area, critical to the whole field of educational technology, which has received very little attention, considering its size and importance, is the analysis of different training or instructional methods from the point of view of their overall effectiveness. The aims of this report are: to review the different research findings from the viewpoint of the methodology and variables involved, to indicate the limitations of the experimentation, and to suggest criteria by which decisions can be made as to which particular teaching method might or might not be most suitable for realising specific learning outcomes.

Headquarters Technical Training Command

Research Section

Task No 234

TT/1499/Research

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SECTION ONE

THE BACKGROUND TO THE RESEARCH FINDINGS

1. A casual examination of the many textbooks that are available on the techniques of teaching will demonstrate the great variety of instructional methods. The most widely advocated of these are based either upon various philosophical traditions or upon the personal needs of the teacher; very little effort has ever been made - with the possible sole exception of programmed learning - to design teaching methods in terms of established principles of learning. Instead, they have been developed from ideas <u>about</u> learning, and partly as a consequence of commonsense and folklore.

2. As a result of the origin of these different teaching methods, a trap besets the path of any writer reviewing the different studies that have been made. Since training methods have arisen outside any proper scientific context, studies which compare the effectiveness of one method with another can hardly be conceived as constituting a valid program of scientific research. The studies cannot be treated as though they constitute a unified body of scientifically gained knowledge, and any sophistication that they may possess usually come from the complicated statistical techniques that they employ which cannot, of course, make up for theoretical naivete.

3. Studies comparing different teaching techniques also lack scientific sophistication in other ways. Since few of the methods are derived from valid research findings, the variables which are available for study reflect few of the properties of being scientifically well developed; they are intuitive in origin, rather than empirical. A further problem stems from the difficulty in defining the methods in exact enough terms, so that when comparisons are made about the effectiveness of different teaching methods the studies are really comparing two largely unknown conditions - comparing one vaguely unknown condition with another.

/4. In view

4. In view of all these difficulties, it is not surprising that few really valid studies have been carried out, and so many of those that are available are generally inadequate, poorly designed and suspect in outcome. Nevertheless, it is still worthwhile viewing the literature in order to try and perceive overall trends. Individual studies are rarely meaningful, since the variables interact and are rarely itemised or controlled. A more significant approach is to survey the whole field of valid experimentation - even here great charity has to be exercised - and to consider the generalisations that emerge. On the basis of these trends, educators and administrators can make decisions which are likely to be slightly more significant, than those based upon the unevaluated value judgments generally employed.

Identification of teaching methods

5. Any teachnig method can exist as an abstract concept, in the sense that it is possible to isolate and describe particular patterns of teacher behaviour. Difficulties which arise in identifying specific training methods stem from the tendency of teachers to adopt particular patterns of teaching behaviour which they rarely modify or change, despite the terminology that they use to describe the method they are employing. Indeed, most of the evidence tends to suggest that teachers find switching from one method to another extremely difficult, and, as a consequence, their behaviour changes very little despite changed teaching circumstances (Jersild, 1939); Williams, 1966).

6. Over the years, however, a number of teaching methods have emerged by repute, and amongst the best known of these are the lecture, the lesson-demonstration, the discussion group,the tutorial, discovery training, programmed learning, brain-storming and sensitivity training (T-groups). With the exceptions of the comparisons that have been carried out comparing the lecture with discussion methods and the lesson with programmed materials - which have both been the focus of considerable research - there has been little valid experimentation, despite a rather voluminous literature (Williams, 1965).

/7. Most of this

7. Most of this research literature tends to be anecdotal in character or else naive in form, so that the task of sorting through the many reports involves considerable labour. In evaluating their research design, a number of criteria must be considered; in any comparative study the content taught should be identical, the presentations should be optimal and the effectiveness of the instructional technique should be measured by accurate and valid criteria involving time, achievement and retention (Cheris, 1964).

8. Once these design considerations have been met, it is possible to begin reviewing the literature in order to discern significant trends. Although little agreement is apparent regarding the most effective use to which particular teaching can be put, a number of generalisations can be made. These are summarised in Table 1 (Davies & Lang, 1965), where it will be seen that lectures, lessons and programmed materials are generally suitable for tasks which are essentially concerned with the communication of information, whereas case studies, group discussions and tutorials are more suitable when there is both an information and attitude change outcome. Role playing, brain-storming and sensitivity training are the most suitable methods when changes in attitude and emotions are the prime objectives. The general effect of using unsuitable training methods is an ineffective training system, which may well fail to realise the objectives sought as well as to increase the training failure rate (Davies & Land, 1965).

Nature of educational objectives

9. Before any particular teaching method can be considered, the nature of the objectives to be realised must be examined. As Table 1 has indicated, some methods are more suitable for providing information, whilst others are better used for changing attitudes and emotions. In the very broadest way, it is possible to recognise three main types of education objectives:

a. Cognitive objectives which emphasise remembering or reproducing something that has been learnt as well as tasks which are concerned with solving intellectual problems and re-ordering information. Objectives

/within this

TABLE 1 : Learning outcomes and associated training methods

PURPOSE	INSTRUCTIONAL METHOD
Explaining facts and procedures; expounding general principles.	Lectures, lesson-demonstration, programmed materials.
Developing analytical skills and the ability to ask questions.	Case method, tutorials, brain-storming, discussion groups.
Developing an awareness of one-self and ones impact on others.	Sensitivity training.
Transfer knowledge to other situations.	Role playing, case study.
Inducing change in behaviour and attitude.	Programmed learning, role playing, sensitivity training, brain-storming.
Ensuring good training with unskilled teachers.	Lectures, lesson-demonstration.

within this domain vary from simple recall to highly original and creative ways of combining and synthesising new ideas and materials. The largest proportion of educational objectives fall within this domain.

b. Affective objectives which emphasise a feeling, tone, emotion or degree of acceptance or rejection. Such objectives vary from simple attention or interest in selected phenomena to complex but internally consistent qualities of character and conscience. A large number of objectives in this domain are normally expressed as interests, attitudes, appreciations, values and emotional sets or biases.

c. Psychomotor objectives which emphasise some muscular or motor skill, some manipulation of materials or objects or some act which requires a neuro-muscular co-ordination. These objectives are most frequently related to drawing, tracking, or physical skills (Krathwohl, 1965).

The instructional methods with which this paper is concerned realise, for the most part, cognitive and affective outcomes.

10. Although it is possible to talk of three broad domains of educational objectives, quite clearly there is a large area of overlap between them; an objective which is clearly within the cognitive domain may have a small affective or even psychomotor component, or vice versa. Table 2 lists the objectives in the cognitive domain, and Table 3 lists the affective objectives. In these two tables, the objectives are classified under a number of headings, which are meaningful to what teachers and trainers actually do in the classroom and test in the examination hall. The objectives in each table are arranged in the form of a taxonomy so that:

a. Each heading represents increasing degrees of complexity as one progresses through the table.

b. Objectives at any level in the taxonomy make use of, and are dependent upon, the objectives which precede them.

Thus the cognitive objectives classified under 'application' include, and are dependent upon, the abilities classified under 'comprehension'; these in their turn are dependent upon those objectives listed under 'knowledge'.

11. Whilst one can have reservations, and quite serious reservations in the case of the affective domain, about some of the categories used in the taxonomies, nevertheless they represent a very useful attempt to demonstrate the hierarchical structure of cognitive and affective objectives. In the cognitive area, for instance, it is possible to distinguish several levels of objectives which can be clearly defined in operational terms (Bloom, 1956):

a. Knowledge is defined as including those behaviours and test situations that emphasise the remembering, either by recognition or recall, of ideas, material or phenomena.

b. Comprehension is used to represent an understanding of the literal message contained in a communication without necessarily relating it to other material.

c. Application requires a student to select appropriate concepts or generalisations and use them in a situation in which no mode of solution is suggested.

d. Analysis is the breakdown of the material into its constituent parts, and detection of the relationships of the parts and of the way that they are organised.

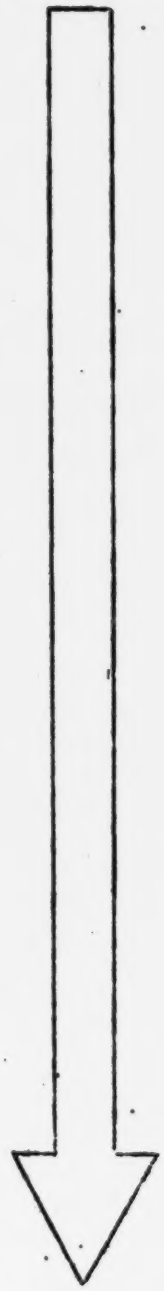
/e. Synthesis is the

Table 2 : Educational objectives in the cognitive domain

Direction	Category
↓	1.00 **Knowledge** (Remembering facts, terms and principles in the form that they were learned)
	1.10 Knowledge of specifics
	1.11 Knowledge of terminology
	1.12 Knowledge of specific facts
	1.20 Knowledge of ways and means of dealing with specifics
	1.21 Knowledge of conventions
	1.22 Knowledge of trends and sequences
	1.23 Knowledge of classifications and categories
	1.24 Knowledge of criteria
	1.25 Knowledge of methodology
	1.30 Knowledge of Universals and Abstractions in a field
	1.31 Knowledge of principles and generalisations
	1.32 Knowledge of theories and structures
	2.00 **Comprehension** (Understanding material studied without necessarily relating it to other material)
	2.10 Translation
	2.20 Interpretation
	2.30 Extrapolation
	3.00 **Application** (Using generalisations or other abstractions appropriately in concrete situations)
	4.00 **Analysis** (Breakdown of material into constituent parts)
	4.10 Analysis of elements
	4.20 Analysis of relationships
	4.30 Analysis of organisational principles
	5.00 **Synthesis** (Combining elements into a new structure)
	5.10 Production of a unique communication
	5.20 Production of a plan or proposed set of operations
	5.30 Derivation of a set of abstract relations
	6.00 **Evaluation** (Judging the value of material for a specified purpose)
	6.10 Judgments in terms of internal evidence
	6.20 Judgments in terms of external criteria

After Bloom 1956

Table 3 : Educational objectives in the affective domain

Direction	Category
	1.00 **Receiving** (Paying attention) 1.10 Awareness 1.20 Willingness to receive 1.30 Controlled or selected attention 2.00 **Responding** (Committed, and actively attending) 2.10 Acquiescence in responding 2.20 Willingness to respond 2.30 Satisfaction in response 3.00 **Valuing** (Concepts are seen to have worth) 3.10 Acceptance of a value 3.20 Preference for a value 3.30 Commitment (conviction) 4.00 **Organisation** (Construction of a system of values) 4.10 Conceptualisation of a value 4.20 Organisation of a value system 5.00 **Characterisation of a value complex** (Acceptance of value system) 5.10 Generalised set 5.20 Characterisation

after Krathwohl, 1964

e. Synthesis is the putting together of elements and parts so as to form a whole, in such a way as to constitute a pattern or structure not clearly there before.

f. Evaluation is the making of conscious judgments about the value, for some purpose, of ideas, works, solutions, methods and materials.

12. The concept of "internalisation" or gradual adoption and commitment is basic to the affective domain. As this process develops, the learner attends, then responds, then values and finally conceptualises phenomena: in other words, he organises his values into a value complex which comes to characterise his way of life. Thus Krathwohl and his associates view internalisation as related to socialisation - but not as a synonym for it: they see "the stages of the affective domain as consistent with an empirically and theoretically based point of view on conscience or super-ego development" (Krathwohl, 1964). Unfortunately, the categories they use in their hierarchy are considerably less hierarchical in character than those found in the cognitive system. Nevertheless, it is possible to distinguish at least three main levels as far as an individual is concerned:

a. Attending or receiving phenomena or stimuli.

b. Actively seeking out something because of a feeling of being committed or motivated, and as a consequence some worth or value is placed upon the phenomena sought.

c. Welding a whole set of values into some coherent philosophy which characterises him as a person.

13. Although it is reported that there is little direct relationship between attitude changes and growth of knowledge (Krathwohl, 1964), clearly no cognitive objective, as is shown in Table 4, will be without its affective component, and vice versa. Furthermore, the relative importance of cognitive and affective objectives is likely to vary considerably from one teaching situation to another; whilst one cannot claim that there is any complete correspondence between the two taxonomies, they are clearly not independent of each other. The element of reception enters into all cognitive tasks, whilst at the analysis, synthesis and evaluation stages some element of selection is involved. This selection element necessarily takes the subject into the higher levels of the affective hierarchy.

14. Although, as we have seen, all levels of the cognitive domain have an affective component, and all affective levels have a cognitive component, these components are rarely in balance. One some occasions, the cognitive component will dominate, as when the teacher seeks to provide information rather than bring about great changes in attitude eg calculus or war studies. At other times, the reverse will be true, and the teacher will provide information only as a vehicle for bringing about attitude change e.g. leadership skills and management concepts. This means that different objectives require different teaching strategies, and the decision as to which strategies should be employed must take into account:

a. The particular domain concerned.

b. The position which the objectives occupy within the domain.

c. The degree of balance between the components.

d. The particular component which is dominant.

There can never be one perfect teaching method which will suit all occasions, since there is a very close interaction between the type of objective which it is desired to realise, the amount of instructor or student control appropriate to the task, the style of leadership and supervision assumed by the teacher and the particular teaching method employed.

Table 4 : The relationship between the cognitive and affective domains

Cognitive objectives	Affective objectives
1. The lowest level in this taxonomy begins with the student's recall and recognition of KNOWLEDGE.	1. The lowest level begins with the student merely RECEIVING stimuli and passively attending to it. It extends to his more actively attending to it,
2. It extends through his COMPREHENSION of the knowledge.	2. then his RESPONDING to stimuli on request, willingly responding and taking satisfaction in responding,
3. to his skill in the APPLICATION of the knowledge that he comprehends.	3. to his VALUING the phenomena or activity so that he voluntarily responds and seeks out further ways to take part in what is going on.
4. The next levels progress from his ability to make an ANALYSIS of the situations involving the knowledge, to his skill in the SYNTHESIS of it into new organisations.	4. The next stage is his CONCEPTUALISATION of each of the values to which he is responding by identifying characteristics or forming judgments.
5. The highest level lies in his skill in EVALUATION, so that he can judge the value of the knowledge in realising specific objectives.	5. The highest level in the taxonomy is the student's ORGANISATION of the values into a system which is a CHARACTERISATION of himself.

after Krathwohl, 1964

SECTION TWO

THE EFFECTIVENESS OF DIFFERENT TRAINING METHODS

1. The ultimate criteria of effective teaching must be the changes which are brought about in the students' attitude towards learning in general and education in particular. Whilst it is not appropriate that this should be examined in this report, it is important to notice that this includes attitudinal and emotional changes as well as more obvious cognitive ones. Thus any examination of the effectiveness of different teaching methods must include an examination of the success of any particular method in realising both cognitive and affective goals.

2. Every educational reformer from the time of Plato has tried to make provision for these two aims by fighting any attempt to relegate the student to an inferior and subsidiary role in the teaching process. Dewey himself stressed that:

> "Since learning is something that the pupil has to do himself and for himself, the initiative lies with the learner. The teacher is a guide and director, who steers the boat, but the energy that propels it must come from those who are learning". (Dewey, 1916).

Thus any teaching method must contribute something towards the realisation of this. It must encourage and stimulate students to learn for themselves; the responsibility of the teacher lies in acting as guide and counsellor, ensuring that students accept responsibility for their own learning by developing in them a taste and enthusiasm for it. Once this precept has been understood, it is possible to review different teaching methods in terms of their success in doing this.

Lecture method

3. The lecture is the traditional teaching method of higher education, and superficially it might seem the easiest teaching method to define and isolate

/since the

since the lecturer's role is conceived essentially as one of transmitting knowledge. Typically the student has few opportunities to make responses during the course of the lecture, although some lecturers encourage students to ask questions either during their presentation or at the end of the session. Probably the best way of defining the lecture is simply to say that during most of the time the teacher or instructor is talking, so that there is very little feedback to the lecturer in terms of student responses. This delay in feedback can seriously hinder the course of student learning, particularly if the student is not well motivated and the material is complex in nature.

4. Evaluation of the lecture has consisted almost entirely in comparing it with the lesson-demonstration and discussion methods. Bearing in mind that one man's 'lecture' may be another man's lesson or discussion (depending upon how one defines lecture technique) it is not surprising that most research workers report that there is no significant difference in the techniques from the point of view of immediate mastery of factual information (Asch, 1951; Bills, 1952; Carlson, 1953; Casey & Weaver, 1956; Deignan, 1956; Englash, 1954; Haigh & Schmidt, 1956; Husband, 1951; Johnson & Smith, 1953; Lifson, Rempel & Johnson, 1956; Maloney, 1956; Slomowitz, 1955; Wispe, 1951; Zeleny, 1940).

5. The equally important aspect of retention has seldom been investigated. Of the three studies that have dealt with this factor, two (Bane, 1931; Rickard, 1946) found retention to be inferior in those groups taught by means of the lecture method, and one (Englash, 1954) found no significant difference. On the other hand, one important study (Ward, 1956) found that there was a tendency for:

/a. Greater retention

a. Greater retention of 'understanding' type material among students with greater academic ability under discussion and lesson presentations.

b. Greater retention of such material under the lecture method with students of lower ability.

c. Students of less ability showed greater immediate recall of information under the lecture method than under lesson and discussion presentations, whereas difference in method appeared to make little or no difference on the part of more able students.

6. When criterions are used which are designed to measure more complex learning outcomes than the acquisition of knowledge, the situation is less confusing. The lecture method is inferior to the lesson and the discussion group for teaching problem solving, scientific attitudes and leadership concepts (Hirschman, 1952; Barnard, 1942; Dawson, 1956; DiVesta, 1954). In a similar way, the lecture method is not a good way of inducing changes in attitudes and emotions (Casey & Weaver, 1956), compared to such methods as the small-group discussion.

7. Two further studies are of particular interest, in so far as they are concerned with rather unusual types of learning outcomes. One investigation (Bloom, 1953) concerned itself with the thoughts of students attending lecture and discussion classes. It reports that the students in the lecture group had significantly more thoughts which could be classified as irrelevant and simple comprehension and significantly fewer thoughts classified as related to other persons and problem-solving. There were no significant differences between the two groups in relation to 'attempts to apply material', or 'evaluating and considering meaning'.

8. Trained observers were used (Edmiston & Braddock, 1941) to record the level of attention shown by a large sample of secondary school students to

/different types

different types of teacher activity. The mean percentage of students attending ranged as follows:

Student report	88%
Student discussion	85%
Lecture	84%
Laboratory activities	81%

It is particularly interesting to note the high percentage paying attention to all methods, and the really slight differences that exist among them.

9. One area in which a good deal of research has been invested concerns itself with different techniques of lecturing. The literature is substantial and growing, but it has been demonstrated that such variables as credibility of the receiver, order of presentation, presentation of one side of an issue before another and the emotions of the argument are all factors in determining the overall impact of the lecture.

10. The main trends that can be discerned are as follows:

a. Changes of opinion are more likely (at least temporarily) if the communication is received from a communicator who is considered highly credible, than if the same communication came from a less credible source (Hovland, 1953) .

b. Threats of punishment, fear of exposure and appeals to senses of patriotism are ineffective, since the greatest changes in attitude occur in those groups in which there was a minimum of this type of reinforcement (Hovland, 1953).

c. When there is a problem in deciding whether to present one side or two sides of an issue, the latter course of action (ethical considerations being equal) should be followed if the audience is an intelligent one,

/or initially

or initially disagrees with the lecturer's position, or is likely to come into contact with the opposing arguments in some setting other than the lecture (Hovland, 1953).

d. Opinions are more likely to change in the direction advocated by the communicator, if the conclusion appropriate to the argument is drawn - rather than leaving it to the students to do (Hovland,1952).

e. When contradictory information is presented in a single communication, by a single communicator, there is a pronounced tendency for those items presented first to dominate the impression received (Hovland, 1952).

f. This primary effect in presenting contradictory information is reduced by interpolating other activities between the two blocks of information and by warning the students against the falibility of first impressions (Hovland 1952).

g. Placing communications highly desirable to the recipient first, followed by those less desirable, produce more opinion change that the reverse order (Hovland, 1952).

Group-discussion method

11. As with the lecture, there is no really acceptable definition of what is meant by the group-discussion or discussion method. In essence the method is almost entirely student-centred, and the students actively participate and co-operate in what is going on. The situation can vary from a largely unstructured one, in which the teacher plays a non-committal, mediating role, to one in which the teacher adopts a severe and autocratic manner.

12. Whilst the actual definition of the method can present some difficulties, a great deal of research has been carried out and the literature on the subject is voluminous. Early observations suggested that people tend to increase their level of activity when they work together as a result of a process called

/"social facilitation"

"social facilitation" (Allport, 1920), and early studies in problems solving certainly indicated a superiority for groups over individuals. It was later suggested (Shaw, 1932) that this superiority might be due to the rejection of erroneous solutions through group discussion. This was later demonstrated (Thorndike, 1938) when the superiority of the group over the individual was shown to be greater in those problem solving tasks which permitted a greater variety of responses - so that it would be highly important for the incorrect solutions to be eliminated.

13. An analysis of later research on group versus individual learning indicates that students generally learn more rapidly in groups. Group experience also appears to transfer, so that students appear to learn more efficiently when they subsequently work on their own (Perlmutter & do Montmollin, 1952). However, there are some limitations: some superior students do <u>not</u> benefit from group learning experience, since over stimulation through the social facilitation process does seem to inhibit learning (Triplett, 1898) under certain circumstances.

14. In discussing the lecture method, it was implied that the discussion group may not be the ideal medium for communicating information. However, it must be remembered that not all knowledge is eagerly received by a well motivated student, and when knowledge encounters any emotional or intellectual resistance, discussion methods are often useful - at least diagnostically.

15. Whilst discussion methods can be used as one means of communicating information, the group discussion method has the real advantage of bringing about changes in motivation, emotions and attitudes. Lewin (1958) showed in his now classic experiments on group decision making processes that it is sometimes easier to change a group than an individual. Changes in attitude, inter-personal relations and in the self-concept have also been recorded

/elsewhere

elsewhere (Asch, 1951; Faw, 1949; Levine & Butler, 1952; Lewin, 1958; Radke & Klisurich, 1947).

16. It would appear that group discussion techniques permit certain types of social learnings to occur which are not possible with the lecture situation, since students are reported to be significantly superior in role flexibility and self-insight than students taught by the traditional lecture method (Gibb & Gibb, 1952). Gibb and Gibb (1952) also report that discussion methods can facilitate the development of group membership skills, and McKeachie (1954) reports significant changes in attitudes of students to negroes and criminals as a result of these methods.

17. It is possible to summarise the main findings of research studies carried out on group discussion methods (Lorge, Fox, Davitz and Brenner, 1958), but the generalisation must be used with some caution. Bearing this in mind it is possible to say:

a. Judgments based upon group consensus are not necessarily any more accurate than the average judgment of individual group members. Judgment, however, is likely to be more accurate from the group situation if the material is unfamiliar or if there is a very great range of individual judgments.

b. Group problem-solving is not necessarily superior to the average solution by individual group members. However, group problem-solving is superior when individual members are familiar with the type of problem, and possess skills relevant to its solution. There is, though, one important qualification; group solutions are very likely to be inferior to the best individual solution.

c. The main advantage of the group situation seems to lie in facilitating the rejection of incorrect approaches, rather than in providing any more approaches to the problem. One exception to this is brain-storming.

/d. Group discussion

d. Group discussion methods seem to be of most benefit to those people who tend to make the poorest individual judgments or solutions to problems

e. When group superiority has been established, it has been a function of the quality of the individual members that make up the group. A group is only likely to solve a problem if at least one individual in that group could have solved it alone.

f. In terms of the time taken, group discussion methods are usually, and often strikingly, less efficient since the method involves far more time than other methods, and time is often wasted discussing problems which are beyond the understanding of less able or well informed members.

g. The presence of other persons has an effect upon individual performance. This appears to be beneficial if they are 'working', but deleterious if they are observing or constituting an audience - this indeed is one very sound argument for closed circuit television.

h. Group discussion methods are far more effective than direct attack in changing expressed attitudes and introducing innovation of any kind.

The results of this research seem to support the assumptions with which this section began. Discussion methods are not completely effective in achieving lower order cognitive objectives, any superiority that this method possesses is to be found in higher level outcomes or in the affective domain.

Lesson-demonstration method

18. The lesson-demonstration is the traditional schoolroom method, and variants of it are used in most technical schools and training colleges. This method is taught as the basis of the instructional techniques courses held at the RAF School of Education, and it has since been widely adopted in many other military organisations - particularly where there are problems with average and below average trainees and a shortage of highly trained and qualified teaching staff. Essentially the lesson consists of an introduction,

/in which

in which the aim is stated, a development - usually featuring a good deal of questioning and class activity - and a consolidation and revision.

19. Despite the great popularity of this method, there is almost a complete dearth of experimental evidence concerning it. To a large extent this may be due to the lack of precision which exists in defining what is meant by the lesson, and also to its transitional character somewhere between the lecture and the discussion. Many of the research findings associated with the lecture and the discussion group can, with good reason, be projected to this transitional technique.

20. One investigation (Pringle & McKenzie, 1965) has compared rigidity in problem solving, between students taught by a traditional lesson approach and those taught by means of a student-centred, progressive regime. No overall difference was found between the two methods, although the less able in both groups showed a significantly higher degree of rigidity of thinking in problem solving situations. Moreover, the less able students in the student-centred group showed greater flexibility in problem solving than the comparable groups using traditional lesson methods. Thus, it seems, that intelligence and educational approach have a differential effect on rigidity, rather than an 'all or none' influence.

Tutorials

21. Tutorial teaching is generally held to be one of the most valuable educational experiences, and yet - like the lesson - this mode of instruction has received virtually no attention from experimentalists. The term itself covers a wide range of activities, of which the most typical are:

a. The Supervision

b. Group tutorials

22. The Supervision, commonly employed in our older universities and now becoming excessively popular in America, consists of a regular meeting of

/student and tutor,

student and tutor, during which the former reads an essay and then defends it in argument. This technique can provide an excellent opportunity for the student to deepen his understanding of the subject whilst advancing his mastery of the basic skills of scholarship, providing:

a. The tutor is both well-informed and sympathetic.

b. The student has prepared his work thoroughly.

If any of these factors are absent, then the whole business can become a time wasting embarrassment. The major obstacle to any wider use of the Supervision seems to be the excessive demands that it makes upon the tutor, the cost of the method in terms of time and staff, and a basic and critical requirement - if the method is going to be at all successful - for extremely able and responsible students (Powell, 1964). Indeed, the later requirement may be the main reason why Supervisions are so rarely used in Redbrick universities, for the successful use of the method depends so much upon an equality in intelligence and ability between student and tutor.

23. The group tutorial arose out of a need to make a more efficient use of staff, and to overcome the requirement for very bright students: the method did not arise out of any real conviction about the intrinsic advantages of working with small groups (Powell, 1964). Only a handful of tutors are sufficiently familiar with social psychology to be able to exploit the potentialities of the small instructional group, so that the striking advances which have been made in the last ten years in group dynamics seem to have been entirely ignored by educationalists (Griend, 1963).

24. One very notable feature of small group tutorials is the wide variability of individual contribution; some participants say very little, whilst others attempt to monopolise the meetings. One investigation (Bloom, 1954) found that contrary to their own belief, most tutors monopolised discussion time, and left little opportunity for the student to contribute. Bloom (1954) and

/Axelrod (1948)

Axelrod (1948) suggest that the quality of discussions can be improved by:

a. Adequate provision of suitable rooms in order to reduce environmental distractions and create a situation in which discussion is facilitated.

b. Making the discussions problem-centred rather than competitive and evaluative, so that there will be less inhibiting anxiety amongst the students taking part.

c. The tutor should act as mentor rather than judge of performance, since judge-like behaviour arouses emotional responses which are likely to obstruct problem-solving behaviour.

Staff and students tend to underestimate the complexity of the processes involved in group discussions, and it is far easier to become an effective lecturer than it is to become an effective tutor. The need for careful preparation is obviously paramount, and it has also been shown (Jenkins, 1948) that some theoretical knowledge of group processes is of value to both tutor and students. A number of sound textbooks are now available in this field (Klein; Olmsted; Miles; Cleugh), so that running group tutorials should be made easier.

Leaderless groups

25. The primary purpose of leaderless groups is to encourage students to work out solutions to problems on their own through mutual criticism and correction. Once this becomes well understood and established, then the tutor becomes redundant. Unfortunately, educators have been slow in utilising this method, although the educational issues are clear and encouraging (Horowitz, 1953).

26. It is already accepted that participation in small group tutorials offers students educational and psychological advantages:

a. Anxiety is reduced.

b. Argument is at a level which can be more readily understood.

/c. There is an

c. There is an absence of authority likely to compel the acceptance of otherwise unsupported statements and opinions.

d. There is a greater degree of freedom to express emotional feelings which can block problem solving.

e. There is a chance to practice a variety of intellectual and social skills.

In the absence of a tutor, these processes can develop without hindrance and restraint.

27. Two serious objections are possible to leadership group techniques: worthwhile discussion might not develop in the absence of a teacher stimulus, and students are unable to challenge and correct fallacious arguments and factual errors. An investigation (Powell and Jackson, 1963) revealed no support for these fears. One word of warning, however, is appropriate. It is quite useless to assign students to groups and to tell them to discuss, careful preparation, briefing and training are necessary (Berne and Levet, 1953).

Brain-storming

28. Brain-storming is based upon the assumption that groups can produce more ideas than can individuals working by themselves, providing the group is so structured as to encourage the expression of unusual ideas which it can later modify as to be fruitful. Essentially the technique consists of a problem solving situation, in which members are given a situation and then asked to bring into the discussion any ideas which come to mind - no matter how outlandish. In this way, the group encourages rather than discourages strange and unusual suggestions, which it discusses, analyses, synthesises, adapts and evaluates. A unique and practical solution is then arrived at from what was originally a rather bizarre solution.

/29. Although the

29. Although the basis of this method appears to be psychologically sound, few careful evaluative experiments have been carried out. One study suggests that brain-storming inhibits rather than facilitates creative thinking (Taylor, Berry and Block, 1958), since the instruction to 'let go' and express all ideas may have a deleterious effect upon group members. On the other hand, Parnes and Meadow (1959) report significantly more 'good-quality' ideas from brain-storming groups than from groups required to present 'good ideas'. The evidence certainly seems to conflict, but the trouble may lie in what is meant by the term 'creativity'. It is in this context that the Parnes and Meadow research may be the more significant, since they used the well known Hanger and Broom AC Tests of Creativity as the basic instruments of their investigation.

Sensitivity training

30. Sensitivity or T-group training attempts to

> "increase a person's sensitivity to and knowledge about personal and intrapersonal factors, together with their influence on thought and action in an attempt to help the student behave more effectively in different and changing intrapersonal relationships ... It is an approach to human relations training which is aimed at getting people to feel and behave differently - and not merely to think differently - with reference to the day-to-day handling of human problems" (Whitaker, 1966).

Put quite simply, T-group training is a technique aimed at using group participation in such a way as to enable the participants to become aware of how they affect others and others affect them.

31. The method has largely been used in the areas of intrapersonal relations, and it is said to have produced dramatic changes in the effectiveness of the organisations in which it has been used. Unfortunately, the problems of evaluating sensitivity training are very great indeed, and the clearest

/evidence still

evidence still consists of the testimonials of people and organisations who have used it, and continue to use it, in order to train their executives and supervisers in leadership and management skills (Tannenbaum, 1961). This method has been recommended to the OCTU for leadership training (Davies and Lang, 1965), and is already being used at the RMC Sandhurst with a considerable degree of success (Adair, 1965).

32. Since its original conception in a training laboratory held at Bethel, Maine in the summer of 1947, the T-group has been regarded as an important social development deserving study for its own sake as well as a special setting in which a variety of problems in group functioning and individual learning can be studied. The research that has been undertaken, therefore, has always tended to have a double goal, and this has been its undoing. Research on T-groups suggests a large checkerboard, incomplete and uneven. Not all students gain from exposure to this method, the general consensus of the studies (Stogdill and Coons, 1957; Pepinsky, Siegel and Van Alta, 1952; Glidewell, 1956; Miles, Cohen and Whitam, 1959) seems to suggest that something like 60 to 75% of the students benefit by exposure to this technique. Similar ranges have been obtained with students discovering creative behaviour in discovering art classes at the Civic College, School of Art, in Ipswich (Young 1966).

33. All of the following qualities have shown themselves to be positively influenced by sensitivity training: various perceptions of the self, affective behaviour, congruity between self-precept and ideal self, self insight, sensitivity to the feelings or behaviour of others, role flexibility, sensitivity to group decisions, behavioural skill, untilisation of sensitivity training techniques, self confidence and approach to diagnosing organisational problems (Bradford, Gibb and Nenne, 1964). This is only a partial list, but these factors do seem to have been shown to change for <u>some</u> people, under

/<u>certain</u> conditions.

certain conditions. The danger is to be found in the fact that since T-groups differ little from group therapy, they could be postively harmful unless handled by sensitive, properly trained people (Fraser, 1966).

Role playing

34. Role playing is a technique which has been widely used to bring about attitude change. Although it is only possible to simulate the reality of experience, it does seem possible to approach this reality and by approaching it take on some of the attitudes and feelings normally associated with the role. Although the method is widely advocated, especially in management training, little experimental evidence is available (Mann, 1956).

35. It is possible, however, from the evidence that is available, that active involvement in a role does influence attitudes in a way which would not be produced by such other methods as emotional appeals or even logical argument (Moreno, 1949). Probably the most crucial factor in any procedure used to produce changes in attitudes and emotions is to be found in active participation by the students (Barnett, 1958 and Abercrombie, 1960). Although attitude change can be induced by discussion groups (Mitnick and McGinnies, 1958), change is greater when students are called upon for active role playing (Janis and King, 1953). However, whatever form the participation takes, the more personal the involvement, then the greater the attitude change is likely to be (Knutson, 1960).

System training

36. The working unit in system training - which has been extensively used in the United States Air Force for the training of aircrew - is the man-machine system. Such a concept involves far more than time-motion and intrapersonal relationships, it concerns itself with the implications of considering the human being as a component of a man-machine system. Such a view makes it clear that the:

/a. Available properties

a. Available properties or functions of man must be considered when planning the mating of man and machine components to achieve the desired system function.

b. Desired properties and functions of man must be exactly specified (and sometimes revised) as the development of the system progresses.

c. Desired man characteristics must be achieved through the selection of personnel, and by employing precise and efficient training techniques.

d. Functional efficiency of the human component must be continuously maintained and tested within the system context.

Planning for the design and development of the human components of systems is not an activity which has been performed in a systematic way over a long period of time. Rather it is something which has arisen within very recent times.

37. System development takes place through any or all of the following system development activities:

a. Establishing system goals.

b. Determining system requirements.

c. Allocating system functions between men and machines by:

(1) Determining information requirements.

(2) Determining transfer requirements.

(3) Determining control requirements.

(4) Establishing a maintenance and logistics philosophy.

d. Equipment design and workplace layout.

e. Establishing manning requirements.

f. Determining training requirements.

g. Training personnel.

h. System test and evaluation.

/The point

The point in the sequence at which information on human capabilities and limitations is first required depends upon the preliminary definition of the goals; it can affect the statement of system goals or may not be required until decisions on man - machine functions are necessary. However, regardless of the point at which the information is used, it has enormous significance to the effectiveness of the final system. A so-called "fully automatic" system can fail because no notice has been paid of the human capabilities.

38. A typical session using this type of training philosophy would consist of a crew or group being presented with a series of problems which are simulated on the crews own CRT, and for which detailed flight plans are available. After working through the problem situations, the crew are given a detailed record of all their interactions. They are then invited to hold a de-briefing session, during which they analyse their faults and attempt to suggest remedies. The goal in sessions such as this is to develop greater flexibility in the crew, so that they can deal more effectively with rapid changes in task assignment by adjusting themselves to all sorts of new problem situations.

39. Experimental data tends to indicate that there is a definite improvement in the ability of trainees to deal with simulated problems, which, it is assumed, will generalise out into any future problems which they may encounter in real life situations (Gagne, 1962). Investigations into conflict behaviour (Miller, 1959) and MacCaslin, Woodruff and Baker's work (1959) in developing a course of training for tank gunners, drivers and loaders all gave similar results.

Programmed learning

40. Programmed learning is based upon laboratory investigations into learning procedures by Professor B.F. Skinner of the University of Harvard, and teaching strategies developed by Norman Crowder of the United States Air Force for the

/training of

training of electronic technicians in fault diagnosis. Although programmed learning takes many forms - of which one method of presentation is a teaching machine - all forms have a common characteristic in that they elicit and systematically reinforce correct, and only correct, responses. This development in the technology of education is already having a considerable impact upon educational and training practices (Ofiesh, 1965; Davies, 1965; Davies, 1966; Davies, 1967; Margulies & Eigen, 1962), and about one-third of the schools in the United States are making some use of programmed material. The advantages of the method are many, but the most important are: active responding by the student, small steps, immediate knowledge of results, self-pacing so that the students can move at their own speed and a low error rate (Lumsdaine and Glaser, 1961).

41. A large number of investigations have now been carried out into the effectiveness of this new technique, and results have tended to show that programmed learning can reduce training time without loss in achievement and retention scores (Davies, 1965a and 1965b; Knight, 1964; Duncan, 1965; Wallis et al 1966). The results of comparisons between students taught by programmed materials and those taught by teachers vary from experiment to experiment, and although the studies alone tell us very little taken together a number of trends (Williams, 1966) are discernible:

a. Human teachers seldom prove to be more effective than programmed materials.

b. Frequently, no difference in effectiveness is to be found.

c. More often than not the program outshines the human teacher.

d. Even where no significant differences in terms of level of subsequent performance is found, programmed instruction usually takes less time.

e. These results hold for long term, as well as short term retention.

/These trends

These trends are summarised in Tables 5 and 6, using 112 research studies involving over 16,000 students.

42. Programmed materials can generally be classified into one of two types, depending upon whether they use a linear or branching format. In a linear presentation there is a straight forward progression from item to item, and only one sequence may be followed; in the branching format, the student can be deflected from the main course into branching or remedial loops which deal with error and then return him to the main sequence. Linear programs appear to embody the features prescribed by Professor Skinner for an efficient learning situation; the student constructs his own responses, which then take him by small regularly reinforced steps to the desired pattern of mastery. On the other hand, there are some very powerful arguments for using branching formats, since the student can proceed more quickly through the material and can follow a sequence relevant to his needs and requirements.

43. The research findings, however, suggest that there is very little to choose between the two styles (Fry, 1960) although this may not be the case with children. As might be expected the constructed response modes of linear programs are a better preparation for examinations using constructed or open ended questions, whilst the multiple choice responses of branching programs are better preparation for Ballard type examinations. However, other expectations are not borne out. It is by no means clear, for example, that branching formats cater better for individual differences. Indeed, ability appears to correlate more highly with success in the case of branching programs than in that of the linear form where no correlation has been found (Fry, 1960; Davies 1966a).

44. At the present time, the main choice when it comes to using programs, is between programmed textbooks and teaching machines, although the use of computers as a presentation mode is beginning to be realised. The machine

/is thought

Table 5

The results of 112 studies comparing programmed with conventional instruction

Measures recorded	Number of studies recording these measures	PROGRAMMED INSTRUCTION GROUP					
		Significantly superior		Not Significantly different		Significantly worse	
		N	%	N	%	N	%
Time taken	90	47	52	37	41	6	7
Test results	110	41	37	54	49	15	14
Re-test results	33	6	18	24	73	3	9

after J. Hartley

Table 6

The results of 112 studies comparing programmed with conventional instruction

Measures recorded	Category	No of studies	PROGRAMMED INSTRUCTION GROUP					
			Significantly superior		Not Significantly different		Significantly worse	
			N	%	N	%	N	%
Time Taken	Military & Industrial	34	23	68	10	29	1	3
	University	19	11,	58	4	21	4	21
	School	37	13	35	23	62	1	3
Test Result	Military & Industrial	36	14	39	18	50	4	11
	University	25	11	44	14	56	0	0
	School	49	16	33	22	45	11	22
Re-Test Results	Military & Industrial	10	2	20	6	60	2	20
	University	4	3	75	1	25	0	0
	School	19	1	5	17	90	1	5

after J. Hartley

is thought to have a number of advantages over the programmed book: the machinery can motivate the student, it makes cheating difficult, it forces the student to carry out the instructions of the program, it can store large quantities of programmed material on film, and some type of limited random access is possible. Valid experimental findings, however, demonstrate no advantage to learning in favour of either the book or the machine, indeed some evidence is becoming available that suggests that students might even favour the book presentation because of its convenience for study (Hudson, 1966).

Discovery training

45. Discovery is a matter of "re-arranging or transforming evidence in such a way that one is enabled to go beyond the evidence so assembled to additional new insights" (Bruner, 1961). Such a definition incorporates Dewey's statement that a student's experiences with the raw material of what is to be learned generate data, from which he may then proceed to discover ideas (Dewey, 1916), and Wertheimer's conclusion that productivity in thinking and learning rises out of the perceptual functions of grouping, centering, and re-organising (Wertheimer, 1959).

46. When these concepts are applied in the classroom, the student is presented with a body of facts or ideas in such a way as to lead him to make correct inferences about unstated facts or ideas from the momentum of the information that has already been presented. Hopefully, the student is challenged to find out for himself by playing an active and thoughtful role in his own learning. The student is not looked upon as a receptacle for a set of conclusions reached by someone else; rather he is an inventor or discoverer who is led to make sequential and cumulative generalisations - adding new breadth and depth to his knowledge.

47. There are two main reasons why this is thought to be an extremely powerful way of learning:

/a. It capitalises

a. It capitalises on the very strong reinforcing value of bringing order, clarity and meaning to previously disorderly experiences. Bruner (1960) has usefully pointed out the importance of establishing 'structures' of knowledge, so that the student can find meaningful relationships among comprehensive ideas, rather than to have to battle with countless isolated and unrelated facts (Friedlander, 1965).

b. Teaching by discovery involves the student as an active participant in his own instruction; he cannot be a discoverer and at the same time a passive observer.

Once these are in operation, it is argued that the student will learn more easily and successfully, and will retain his knowledge more completely than he would from a system of facts and ideas imposed upon him from such an outside source as a book or teacher. In this way, not only can he realise cognitive objectives, but high order objectives in the affective domain can also be achieved.

48. In one of the basic references on discovery training (Bruner, 1961) it is claimed that the act of discovery benefits the learner in four ways:

a. The learner's ability to learn related material is increased.

b. An interest is fostered in the material itself, rather than in the rewards which may follow from learning.

c. An ability is developed to approach problems in a way that is more likely lead to a solution.

d. There is a tendency for the material learnt to be easier to retrieve or reconstruct.

In a later article (Kersh, 1962), learning by self discovery is said to be superior to learning with external direction by a teacher only in so far as it increases student motivation to pursue the learning task. If the student

/is sufficiently

is sufficiently motivated it is claimed, he will continue the learning process autonomously beyond the final period of teaching. However, meaningful learning which does not increase motivation, is unlikely to improve retention or transfer to other situations.

49. Despite these very strong claims, the research evidence - although meager - is not especially favourable (Goldstein, 1956; Novak, 1958). Part of this may well stem from the type of measuring device that has been used in making the comparisons; usually these emphasise the mastery of fact hardly one of the objectives of this particular method. When more realisti devices have been employed, there is some suggestion that students develop superior skills in solving directly related problems (Dawson, 1956). A further study (Gagne & Brown, 1961) tends to suggest that guided discovery is a more efficient method than learning by rule and example or discovery alone.

50. Although not properly based upon research findings, Friedlander (1965) makes a number of extremely pertinent remarks as 'second thoughts' about discovery training:

a. Discoveries do not necessarily lead to productive findings and resolutions.

b. The discoverer may come to a wrong conclusion or to a confusing outcome. Hopelessly chaotic chains of mistaken inferences and deductions can follow from these false discoveries.

c. There is no evidence that better retention follows from discovery training.

d. Discovery is incomplete as a learning process; it needs consolidation, otherwise discoveries are forgotten or underestimated.

e. Discovery may operate in different ways with different people, only certain people may be fruitful discoverers.

/f. Discovery

f. Discovery training may lead to non-participation by a large proportion of the class.

g. Students are not capable of criticising themselves and evaluating their own discoveries.

h. The effectiveness of the method depends very much upon the judgment and ability of the teacher.

A final study (Corman, 1957) under lines many of these remarks. He points out the difficulties which are encountered in providing students with an appropriate amount of guidance, without undermining the essential discovery aspect of their learning.

Student Centred Learning

51. Teachers and educators have long been critical of the practice of spoon feeding students and packaging education. There have been numerous attempts to break away from the traditional teacher dominated classroom situation, so as to encourage greater student participation and responsibility. Many universities and colleges, as well as the United States Air Force, are experimenting with student centred learning procedures as a regular teaching technique.

52. There is nothing new in the proposition that one way of helping trainees to enrich and accelerate their own learning is through independent study; however, for a long time this has been held to be the special perogative of the gifted student. What is new in this approach is the use that is being made of independent study as part of the teacher's regular classroom procedure, together with its employment with all types of student. Independent study can be defined, within the limits of this investigation, as "independent work or reading, sometimes on ones own and sometimes in small groups, but with such working taking place in the absence of the teacher and in lieu of certain regularly scheduled class meetings" (Baskin, 1960).

/53. The nature

53. The nature of the experimentation has varied from its use in a single course to its employment in several courses, from the use of individual or lone-wolf methods to the use of team and small group approaches, and from the use of independent study arrangements in which students were expected to work independently over a substantial period of time with no formal class contact with the teacher to arrangements under which the students met in regularly scheduled class sessions throughout the course - but where the number of such weekly meetings had been reduced. In all instances the students were expected to work independently for at least a certain portion of their time, and in all cases the procedures were applied to all students in the particular course of study. (Antioch College Reports, 1963). This student centred learning approach holds great promise as a means of preserving some of the traditional values of higher education during an age of rapid expansion (Powell, 1964).

54. Table 7 lists some of the ways in which studeht centred methods are thought to differ from traditional instructor centred approaches. One study which summarises a whole group of experiments (Fund for the Advancement of Education, 1959) states that:

> "Almost without exception, the customary academic examinations showed that students in the independent study experiments learned at least as much as the students who had regular class work. Rarely were there statistically significant differences in the performance of the experimental and control groups on regular or special examinations".

The report also indicates that while students at first expressed dissatisfaction with these methods of instruction, in that they felt that they were 'missing something' because of the diminished contact with the teacher, student satisfactions grew as they became familiar with what was involved.

/55. A further

Table 7

A COMPARISON OF STUDENT-CENTRED AND LEARNER-CENTRED APPROACHES

Student-centred	Instructor-centred
GOALS	
Determined by group.	Determined by instructor.
Emphasis upon affective and emotional changes.	Emphasis upon cognitive or intellectual changes.
Attempts to develop feelings of individual responsibility amongst group cohesiveness.	No attempt to develop group cohesiveness.
ACTIVITIES	
Great amount of student participation.	Much instructor participation.
Student-student interaction.	Instructor student interaction.
Group decides upon own activities.	Instructor determines activities.
Discussion of students personal experiences encouraged.	Discussion kept to course materials.
De-emphasisof tests and grades.	Traditional use of tests and grades.
Students share responsibility for evaluation.	-
Instructor interprets feelings and ideas of students when it is necessary for class progress	Instructor avoids interpretation of feelings.
Reaction reports.	No reaction reports.

55. A further investigation spread over four years at Antioch College (Antioch College Reports, 1961) suggests that:

a. Students learned equally well whether they studied under the regular method of instruction or under the experimental method of independent study. No significant pattern emerged favouring one group or the other. This held true regardless of the type of examination used to measure achievement, and it held true for both beginning and advanced courses.

b. Data on retention (two years after the course had finished) revealed no significant differences favouring one group over the other.

c. There was no evidence that the independent study methods needed to be reserved for the superior or advanced student.

While students still tended to prefer the lecture-discussion type of teaching, they expressed growing acceptance of, and satisfaction with, independent study as they became more familiar with it. The study data showed a decided shift in student attitudes at Antioch College from one of decided dis-satisfaction with independent study in 1956 to few differences in the degree of satisfaction under either method of instruction in 1960.

SECTION THREE

EXAMINATION OF THE VARIABLES AFFECTING DIFFERENT TEACHING METHODS

1. A study of the effectiveness of different teaching methods would be incomplete without an examination of some of the more important variables related to the overall learning and instructional process. These variables can be manipulated by the teacher in such a way as to have the most profound influences upon the actual course of learning, and although great importance is often laid upon them - indeed some like the size of class have political significance - the amount of actual experimentation within the area is very limited. Indeed, the strong feelings that educators often express about the variables are, to a very large extent, based upon sentiment rather than upon fact.

Teacher attitudes and characteristics

2. Intuitively it is often supposed that the attitude of the teacher is basic and significant to student learning. Direct evidence upon this point is very meagre, and even trends within research reports fail to suggest that it might be significant. A recent summary of summaries, as it were, on this matter finally concluded:

> "Even though there is a vast body of research on the relation of teacher characteristics to effectiveness in teaching, the reviews of this research (Domas & Tiedman, 1950; Barr, Eustice & Noe, 1955) show no consistent relation between any characteristic, including intelligence and teaching effectiveness" (Brim, 1958).

3. Several investigators, finding that the more popular and better adjusted students are the better achievers, have concluded that a good classroom climate will promote excellence. Two studies, however, obtained negative results. One (Hawkes & Egbert, 1954) found no relationship between empathy and teaching success, and the other (Gage, Leavitt & Stone, 1955) found that the teachers' understanding of the intellectual and personal problems of their students was not significantly related with students' ratings of their teachers. A study by Heil, Powell & Feifer (1960) stands alone in relating achievement to any interaction between

/teacher .....

teacher and student personalities. They found that the well integrated (self-controlling) teachers were the most effective with all types of students, whereas the weakly integrated (fearful) teachers were ineffective with everyone except the 'strivers'.

Style of Leadership & Supervision.

4. The style of leadership exercised by the teacher in his classroom can have important consequences upon the course of learning. In any group learning situation, the style of leadership is determined more by the expectation of the members and the requirements of the situation, than by the personal traits of the leader himself. To a very great extent, the teacher-leader is better able to affect the classes means of achieving objectives than its actual objectives, although the teacher will tend to direct activities along the lines in which they themselves are skilled and proficient and away from those areas in which they lack competency. The greatest danger seems to lie in the actual life of the leadership; the longer this tends to be, then the less open and free is the communication within the group. Those groups which experience leaders who have had long tenure of office are probably less efficient in solving new problems (Merci, 1958).

5. Clearly leadership and supervision play a very important part in group performance, and many studies seem to demonstrate that the greatest efficiency and highest morale occurred with a 'democratic' leader, who encouraged participation in decisions, gave a clear picture of the group activities and the reasons for his requests, and took an active - but not over-active - role in the group's activities. The laissez-faire or passive leader who allowed complete freedom and assumed no active role was normally associated with the least efficient situation. Whilst the autocratic leader, who was very active in issuing commands, without giving explanation, was effective in raising achievement only while the group was under his immediate surveillance. Morale was lowest in the autocratic situation (White & Lippit, 1960). Other studies in industry confirm that productivity and morale are higher with a participatory

/leader .....

leader or supervisor, who assumes an active role in the group, supports his subordinates, delegates authority and maintains an optimal degree of supervision (Kahn & Katz, 1954). There is similar evidence that group orientated roles on the part of the teacher and instructor may also lead to improved learning.

6. The supervision of a trainee's work always presents a number of difficulties, particularly in the decision as to whether to use close, detailed supervision or general supervision. In general, close supervision is undesirable, except when the teacher is accepted as a member of the group who is responsible for their well being; in these circumstances, frequent checking of the student's work in such a way as <u>not</u> to reduce their freedom of action may develop high performance norms in situations where students have considerable control over how they carry out their actual assignments. Checking, therefore, should take the form of advice and encouragement, rather than in detailed orders and instructions, which only result in apathy or resentment (Patchen, 1962).

7. The style of leadership and the style of supervision also affects the actual cohesion and operation of the class or group. Active teacher-leaders (who guide, persuade, direct and coerce) are characteristic of those groups who determine their own activities, while passive teacher-leaders (who mediate, serve as models and co-ordinate activities) are characteristic of those groups whose activities are imposed upon them from outside. In small group or class work, different styles of leadership by the teacher can have different consequences:

a. Authoritarian leaders tend to be least effective in holding the group together and in getting work done.

b. Democratic leaders tend to be most effective in respect of the durability of the group, members' satisfaction, their independence vis-a-vis the teacher and their productivity on the task(White & Lippitt, 1960).

8. However, personality differences can blurr these generalisations, since "authoritarian personalities prefer status-laden leadership, accept

/strongly .....

strongly directive leadership and regard the authoritarian leader as 'better' than his more democratic counterpart". Indeed, they will tend to express open hostility towards the leader as soon as he reveals any sign of weakness. Equalitarian personalities, on the other hand, accept authoritarian leadership only as the circumstances demand (Gibb, 1954).

9. A further difficulty arises when the teacher-leader must simultaneously satisfy two necessary but conflicting group needs:

a. The need for initiative, guidance and contribution of ideas etc (the intellectual leader).

b. The need for harmony, liking and mutual acceptance etc (the social leader).

Unfortunately, few teachers are able to combine these two qualities; they may begin by trying to fulfill them, but before long they become differentiated and any weaknesses become exposed. In one series of experiments, the highest position on both "liking" and "ideas" was held by the same person in 56% of the cases in the first session, but this fell to 12% at the second and was down to 8% by the time the fourth session had ended (Slater, 1955). This trend is closely related to two other modes of expression within the group - advancing the task and keeping the members happy. When faced with a decision, most group leaders give up advancing the task in favour of keeping the group happy; those who tend to control the group, lose in popularity (Bales, 1953).

Spatial relationships

10. The communication network within a class can affect the group's performance and the member's satisfaction in a number of ways. They can be summarised (Leavitt, 1958) as follows:-

a. One-way communication is considerably faster than two-way communication.

b. Two-way communication is more accurate than one-way communication.

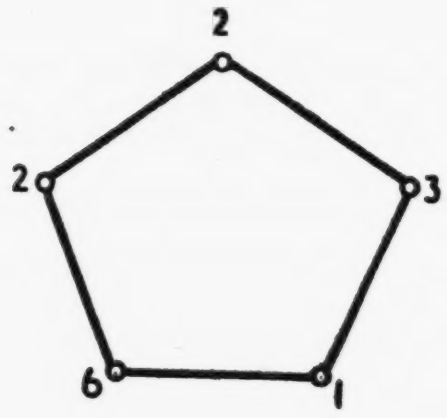
c. The receivers are more sure of themselves and make more correct judgments on how right or wrong they are in the two-way system.

/d. .....

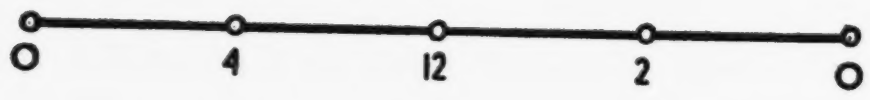
FREQUENCY OF OCCURRENCE OF RECOGNIZED LEADERS AT THE DIFFERENT POSITIONS IN PATTERNS A, B, C, AND D.

FIGURE 1

A



B



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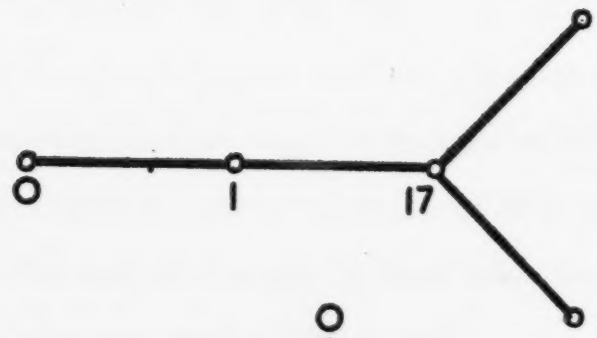

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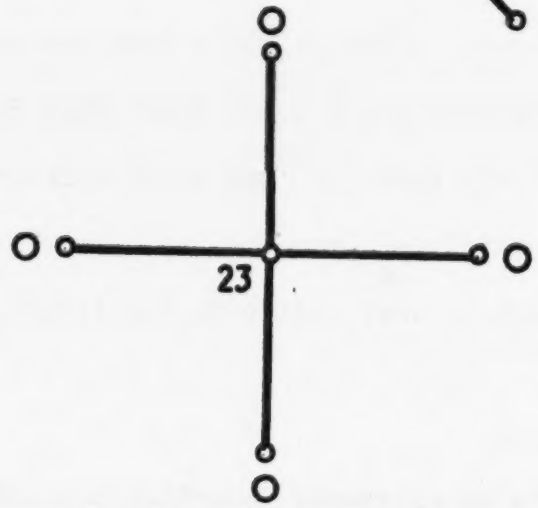
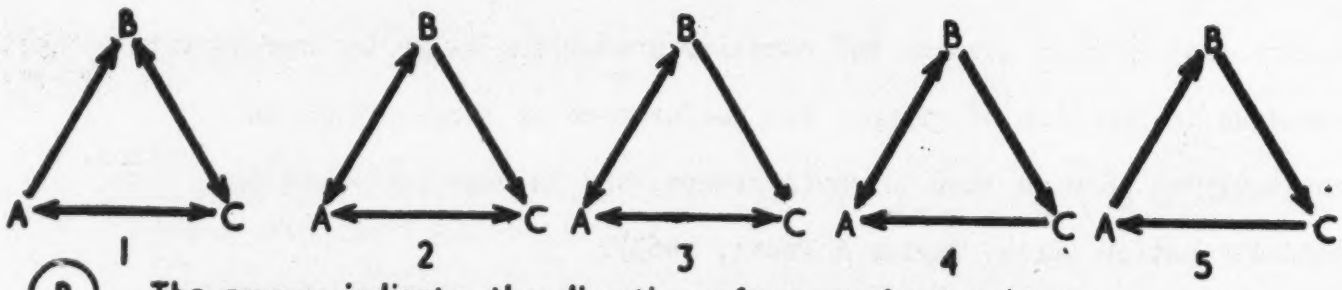


(A) The leader amerges at the position of highest centrality

THE FIVE NETS



(B) The arrows indicate the direction of communication from talker to listener

d. The sender finds himself feeling psychologically under attack in the two-way system, because his receivers pick up his mistakes and oversights, and let him know about them.

e. The two-way method is relatively noisy and disorderly. With people interrupting the sender and one another, with the slowest man holding up the rest and so on. (See fig 1).

f. The one way method appears neat and efficient to an outside observer, but the communication is less accurate.

11. Groups whose problems require the collation of information from all members work faster when one position is highly centralised and the others relatively peripheral. However, morale, self-correctiveness, and perhaps creativity in such groups may be better when the communication network is more equalitarian and when each member has more than one source of information. Steinzor (1950) has found that when groups of ten were seated in a circular pattern, then those sitting opposite each other tended to interact more with each other than with those on each side of them. He suggests that this can be used by placing reticent members opposite talkative ones, while people who tend to monopolise the discussion can be placed in adjacent positions. Although there have not been many attempts to correlate individual interaction - rates with other factors, there is some evidence (Knutson, 1960) that the more vocal members of discussion groups are more satisfied with their progress and produce better quality work than those who contribute very little to the discussions.

Size of the group and class

12. The size of group is an extremely important variable in group performance, and is often discussed with great passion. However, Thomas and Fink (1963) in summarising the whole literature on this subject conclude that in considering group performance findings as a whole, it appears that in both quality and quantity production tends to improve with increases in the size of group. The performance of large groups is inevitably as good as that in small groups, and in some instances is decidedly better (Vide, Taylor & Faust, 1963).

/13. .....

13. Regardless of the effectiveness of different sized groups, the size of group also has a number of consequences. Generally speaking, the larger the group:

a. The greater the demands on the teacher, and the more he is differentiated from the membership of the group at large.

b. The greater the group's tolerance of direction by the leader and the more centralised the situation becomes.

c. The greater the tendency for the more active members to dominate the interaction within the group.

d. The more the ordinary members become inhibited in their participation, so that the group's discussion becomes less exploratory and adventuresome.

e. The less intimate the group atmosphere, the more anonymous the actions and generally the less satisfied the members as a whole become.

f. The longer it takes to arrive at non-verifiable (judgmental) decisions.

g. The more acceptable the unresolved differences.

h. The more competing the subgroups become.

i. The more formalised the rules and procedures of the group.

Most of the research studies, seem to demonstrate a watershed for these tendencies in group methods around the 5 to 7 mark. Beyond this point, formality in leadership emerges rapidly, tension decreases, attitude changes becomes less marked, resistance to new ideas reinforced, and group solidarity increases (Bales et al, 1957).

14. Table 8 is representative of the type of analysis into the interactions which occur within experimental groups of different sizes (Bales & Borgatta, 1955). The table demonstrates that as group size increases, tension release (jokes, laughs, smiles etc) and giving suggestion (direction etc) become more marked; signs of solidarity (help, rewards and indications of status) as well as the giving of information (reptition, clarification and confirmation) also somewhat increase. On the other hand, tension (requests for help,withdrawal) shows a considerable

/ increase .....

TABLE 8:

INTERACTIONS WITHIN GROUPS OF DIFFERENT SIZES *

Category of Behaviour	Group Size: 2	3	4	5	6	7
	Sum: 8	12	16	20	18	28
Shows solidarity	9.2	9.1	10.3	9.7	11.2	10.5
Shows tension release	11.2	11.4	12.8	14.8	18.4	16.6
Agrees	27.2	27.0	22.3	23.1	21.6	21.3
Gives suggestions	14.3	13.5	13.7	15.9	18.4	19.2
Gives opinion	31.7	34.0	35.0	32.0	32.1	31.2
Gives orientation	25.3	23.3	23.7	26.6	24.1	25.7
Asks for orientation	12.0	10.2	10.5	10.2	10.2	10.1
Asks for opinion	9.8	8.5	8.2	8.5	7.4	7.1
Asks for suggestion	5.2	5.9	5.0	6.4	4.6	5.9
DDisagrees	10.2	15.6	19.9	14.5	17.7	16.4
Shows tension	12.4	8.6	10.0	9.1	6.3	6.6
Shows antagonism	1.0	3.5	5.2	3.3	3.9	3.8

* The profile of each individual is the sum over four sessions of his raw scores in each session. This has then been normalised for comparative purposes.

increase as the size of group reduces, whereas agreement (passive acceptance, understanding, compliance etc), asking for opinion (evaluation, analysis and expressions of feeling), and the giving of opinion (evaluation, analysis, expressions of feeling or wish) all increase as the group size is reduced.

15. Most of these trends appear to be the results of two main factors:

a. As group size increases, so the amount of talking time available to each of the members is reduced.

b. As group size increases, each member of the group has to maintain himself in a more or less adequate relationship with more and more people.

This means that with increases in the size of the group, each member of that group has to maintain more and more relationships with less and less time available for him to reinforce and cement them. (Bales & Borgatta, 1955).

16. A certain amount of research has been carried out with different sizes of small groups, (tutorials, small discussion groups, T Groups, brain-storming, case studies etc) in order to investigate their particular properties (Mills, 1953). The results can be summarised as follows:

a. <u>Groups of Two.</u> In this size group, a delicate balance is involved since there is no support within the group for either participant should a disagreement arise. Mutual tolerance of each others ideas is, therefore, a main characteristic of successful groups of two. Generally speaking, the main properties of this type of organisation (as in a tutorial or with two students working together) tends to be high tensions and emotion, a tendency to avoid disagreement, high exchange of information, high probability that deadlock will be reached with consequent instability and a high differentiation of roles - one person as an active imitator and the other as a passive controller often with powers of veto.

b. <u>Groups of Three.</u> This is probably the most stable form of group size in so far as one tends to have shifting coalitions. In any particular role, the two most active members form the pair,

/whilst the .....

whilst the least active member is relatively isolated. However, this primary tendency - especially in problem solving situations - for segregation into one pair and one other tends to shift, so that the pair is constantly changing.

c. Odd versus Even Groups. The evidence seems to show that there is a greater tendency for more disagreement to occur in even groups (4,6,8) than in odd groups (3,5,7), owing to the formation of equally sized sub-groups.

The most satisfying group size would appear to be five, since this seems to give ease of movement within the group, whilst the 2:3 division provides support for the minority members. At the same time, the group is large enough for stimulation to occur because of the variety of its members, and small enough for participation and personal recognition. Increasing maturity will permit effective utilisation of larger groups, but the tendency is still for five to be the most efficient and effective unit (Bales & Borgatta, 1955).

17. The research findings for medium sized groups (lesson-demonstrations, small lecture groups, etc) are more problematic. Many teachers complain of the difficulties of working with 'large' classes, and hopefully wish for the day when classes can be reduced to the 'ideal' size of twenty-five. There is, however, no experimental evidence whatsoever in favour of medium sized groups of twenty-five, and the only authority for this figure, which has been handed down in successive educational textbooks, is a statement in the fifth century Talmud.

18. One early experiment (Edmonson & Mulder, 1924) compared the effectiveness of two matched groups of university students - one a group of 45 and the other a group of 109. This pioneer study led to the conclusion that size of class is not a significant variable in medium sized groups, although students generally preferred the smaller class. Similar results have been reported by Hudelson (1928)when using classes of 20 and 113, and by Brown (1932). In fact, using special team procedures, Brown produced slightly better achievement in groups of sixty than were obtained from

/classes of .....

classes of twenty-five.

19. More recent experimentation has been less favourable to large classes. Rohrer(1957) found no significant differences, while Macomber and Siegel (1956, 1957a, 1957b, 1960) demonstrated that whilst statistically significant differences favoured small classes (particularly with high ability students), most of these differences were very small. Significant differences favouring the smaller sized groups were only found when changes of attitude and problem solving were involved. When retention was measured two years after the completion of the courses, large classes did not prove to be significantly inferior to small classes in any of the courses. The staff involved in the Macomber and Siegel project felt that large classes for lectures were about equal to small lecture classes in covering content, but inferior to achieving objectives.

20. One may perhaps summarise all this research by saying that:

a. Large lecture classes are not generally inferior to smaller lecture classes, if traditional tests and examinations are used as the criterion measure.

b. When other objectives are measured, large lecture groups tend to be inferior.

c. Generally speaking, both students and staff feel that teaching in small classes is more effective.

<u>The clash between teaching principle or knowledge.</u>

21. A persistent difficulty which confronts any teacher - but especially the Lecturer - is the problem of deciding whether to expound broad principles in class or whether to teach the detailed knowledge upon which such principles are founded. Different teachers solve the problem in different ways, but the issue has been examined (Erskine & D'Morchoe, 1961) in a particularly well designed experiment concerned with teaching science. One class stressed principles and omitted detail, whilst another class was taught both. The principles class scored higher marks in the examinations testing achievement, but there was no difference between the two classes on a retention test. Too much detailed information tended to confuse and

/dismay the .....

dismay the weaker students, whilst over-whelming the conscientious ones who were determined to master everything. Both groups end by doing themselves less than justice.

Teaching Aids

22. It is not the purpose of this paper to examine the effectiveness of audio-visual aids, the subject would require a far more comprehensive treatment than can be given here. However, despite the number and variety of teaching aids available on the commercial market, we are still living in the steam age both from the point of view of their utilisation and experimentation with them. The Yearbook of Education, 1960 was devoted entirely to this subject, whilst one of the best textbooks for those who wish to improve their skills in this area is by Wittich & Schuller(1957).

23. The most common of all aids is the chalkboard, which despite very clear research findings (Seymour, 1937) demonstrating the superiority of light-coloured surfaces still remains black. Interesting results have been obtained with the overhead projector which has the great advantage of flexibility (Cartmell, 1965), although research findings are of a purely anecdotal character.

24. Films and filmstrips have been the subjects of considerable research particularly by the Americans during and at the end of the last war. In all cases, their success has been demonstrated, but participation in such other activities as note taking whilst watching a film can result in a learning loss (Ash & Carlton, 1953). The great mass of literature dealing with research on films can be summarised under the following principles (Miller, 1957):

a. Students can learn from films and usually do learn at least as much as from a poor teacher.

b. Such learning is not confined to details, but may include concepts and attitudes.

c. Repeating the film increases learning.

/d. Students .....

d. Students can learn how to learn from films, i.e. students with previous experience in learning from films learn more than those with no previous experience of instructional films.

e. Presenting pictures is more effective than presenting words as stimuli in rote association tasks such as learning a foreign language.

f. Participation increases learning.

Many of these research findings can, of course, be transferred to television, which has additional flexibility and mobility, and can bring an immediacy and reality into the classroom impossible with other methods.

Classroom climate

25. When people associate with one another under conditions of equality, attitude changes are likely to occur since small groups tend to generate shared values and shared contact. This growing homogeneity of outlook leads to increasing satisfaction and personal ties:

> "Interaction between persons leads to sentiments of liking which express themselves in new activities, and these in turn mean further interaction .... The more frequently persons interact with one another, the stronger their sentiments of friendship for one another are apt to be .... The more frequently persons interact with one another, the more alike in some respects both their activities and sentiments (i.e. attitudes) become". (Homans, 1950).

In most cases, then, small groups of people tend to generate interaction, and the greater this interaction then the more the members of the group share opinions among themselves and so converge in their judgments on the topics under consideration.

26. Small groups strongly influence the behaviour of its members, by setting and/or enforcing standards for what it considers proper behaviours. In this regard, the more stable and cohesive the group tends to be - and the more attached the members are to it - then the more influential the group is for setting standards for behaviour. This is of particular importance when the group has deviant members; in this sort of group, the

/behaviour of .....

behaviour of deviants is more likely to change to meet the standards of the modal members than vice versa. Modal members are more numerous and so can exert more pressure, and furthermore they tend to be more moderate in their approach than the deviants who - by their very nature - are extremists. Thus modal members represent a compromise on the issues involved, and in this way they hold the group together.

SECTION FOUR

CONCLUSION

1. Research on teaching methods which will contribute to an organised body of scientific knowledge requires that the teaching methods themselves are designed systematically in terms of empirically established learning principles. Yet the design of such methods represents a branch of educational technology that is still very much in its infancy; most of the attempts that have been made - with the possible sole exception of programmed learning - have provided only the flimsiest foundation for any later experimentation.

2. The rational for experimentation is, however, pressing. It lies on several bases: it is to be found in the educator's and trainer's desire to find new ways of learning and to improve the quality of the student's overall educational experience, it is to be found in a general desire to reduce the 'detail' burden of the teacher and to provide him with new ways of carrying out his own programs of research and development. Certainly much of the impetus for the experimentation that is now going on in education grows out of the present emphasis for the more effective and efficient utilisation of instructional resources.

3. Despite the general paucity of research into teaching procedures, enough has been done to provide positive assistance to those who genuinely seek to improve their skills as lecturers, teachers, trainers and instructors. If teaching is worth doing, it is worth doing well, and there can be lettle excuse for any lack of concern; magnificent buildings and expensive equipment can never compensate for dreary and lifeless teaching.

4. Teachers who make decisions as to which teaching method is most likely to help them realise particular learning outcomes in their students, are behaving in highly professional manner. The research findings might be confusing and might lack dogmatism, but a number of guidelines are to be discerned. These are summarised in Figure 2, where teaching methods are plotted against the degree of control exercised and the objectives to be

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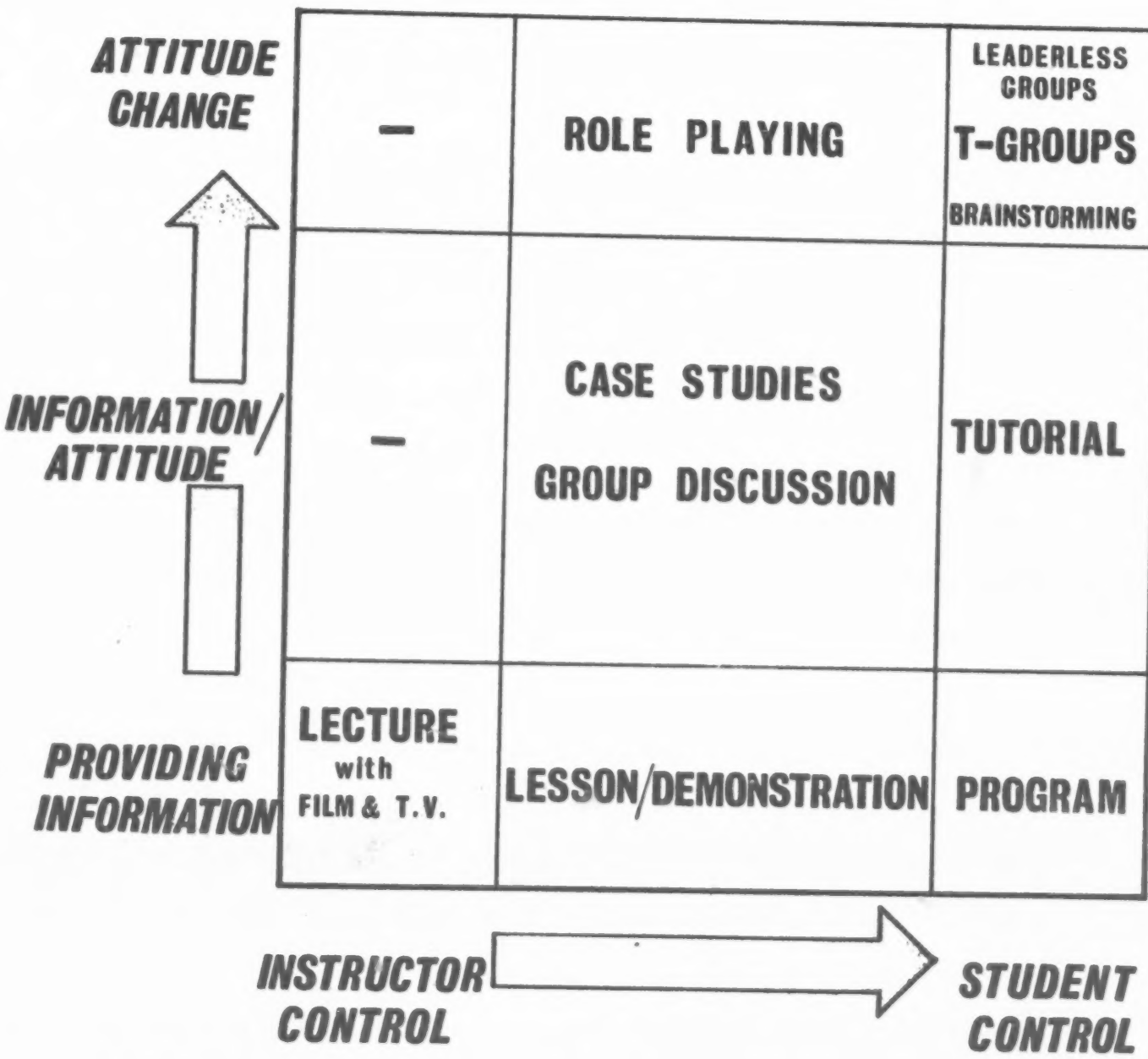

FIGURE 2. MATRIX OF INSTRUCTIONAL METHODS

realised. It will be seen that attitude changes can only be brought about in a controlled and realistic manner, by making use of those teaching methods which allow the student to participate, co-operate and to a large extent control the course of his own learning. By very definition these methods cannot be teacher-based, and by definition these methods are likely to be inefficient when judged from a criterion of information communicated and skill acquired. On the other hand, cognitive skills are efficiently realised by teacher-orientated methods, in which the degree of student participation must necessarily be limited.

5. The conclusion is inescapable: the educator and teacher must exercise a professional diagnotic judgment in the light of their experience and the observed circumstances. Once the complication of teaching and learning has been recognised, with all its delicate balances between freedom and discipline, imagination and critique, fact and concept, memory and forgetting, it hardly seems likely that any one method or formulae can fit all cases. Only the wise intervention of a sensitive and sympathetic teacher can hold these shifting stresses in equilibrium.

6. It seems more and more clear that good students are going to need good teachers more than ever before. Formerly a teacher could perform simply as a passive agent, acquiescently dispensing pre-packaged bundles of skill and information that had been approved by tradition. Today that tradition is suspect. In order to fulfill his role successfully, the modern teacher must play an active part in deciding what to teach and how to teach, each decision must be adjusted to both long range objectives and the needs of the moment as seen from the students viewpoint. The controlling factor at every stage must be the student, the objectives and the resources available to meet them.

Squadron Leader I.K. Davies
Headquarters Technical Training Command,
1 June 1966

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